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The Resources Agency
DEPARTMENT OF FISH AND GAME

STANDING STOCKS OF FISHES IN SECTIONS OF INDIAN CREEK, PLUMAS COUNTY, 1993

by

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INTRODUCTION

In 1976, the Department of Water Resources (DWR) initiated an instream flow program to identify streams that would benefit from flow enhancement to assess instream values required to enhance these streams. The Northern District of DWR selected Indian Creek below Antelope Reservoir (Figure 1) as one of the streams to study under this program. Initial flow studies by DWR indicated that flow augmentation could double trout habitat in the first 16 km of Indian Creek below the dam and increase habitat by 25 percent in lower reaches (DWR 1979). As a result of this study, DWR and the Department of Fish and Game (DFG) reoperated Antelope Reservoir in March 1978 to increase flow releases from 0.1 cms to 0.6 cms year-round on a trial basis to enhance recreation and fishery values (Hinton 1983). Brown (1993) reported that increased flows had increased trout standing stocks and numbers of catchable trout.

Sampling of salmonids was begun in Indian Creek at six different stations in 1977. Sampling continued through 1982 on a yearly basis to provide baseline data for salmonid biomasses (Brown 1978, Brown and Haines 1979, Haines and Brown 1980, Villa and Brown 1981, Villa 1982, Bumpass et. al. 1987a). Fish were not sampled in 1983, 1984, or 1985. Sampling resumed in 1986 and continued in 1987, 1988, 1989, and 1990 (Bumpass et. al. 1987b, Bumpass and Smith 1989, Bumpass and Brown 1989, Brown 1991a, and Brown 1991b).

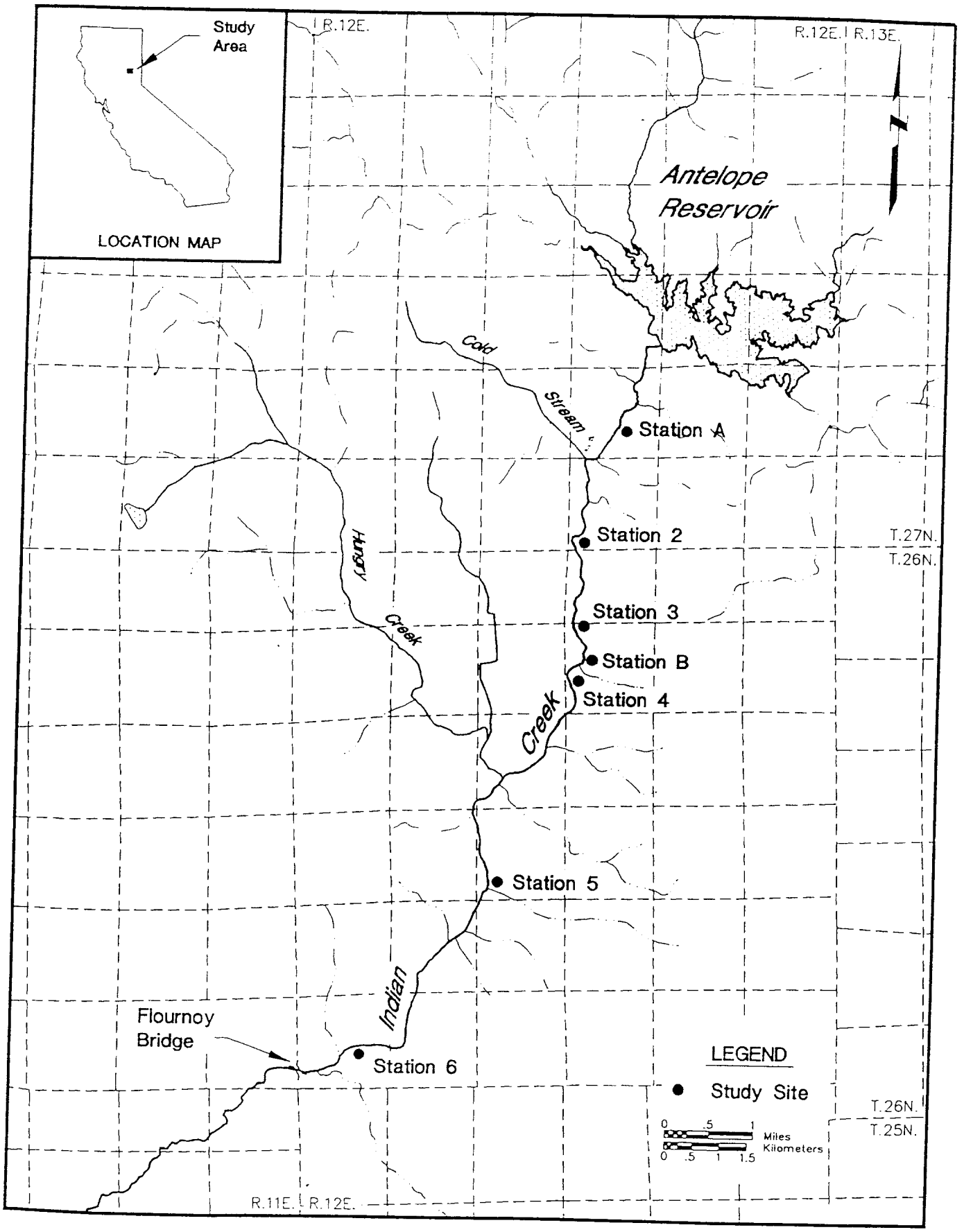

Figure 1. Stations sampled to determine biomass of fishes in Indian Creek, Plumas County, September 1993.

STUDY AREA

The Indian Creek study area extends from the stream at the base of Antelope Dam to Flournoy Bridge (Figure 1). The stream flows through rocky canyons and grassy meadows. Elevation in the study area averages 1464 m. Steep hillsides surrounding the stream are covered with pine, cedar, and fir trees. Trees that border the stream are predominantly alder. Indian Creek averages 7 m in width in the study area.

Stream flow is a combination of releases from Antelope Dam and inflow from tributaries such as Cold Stream and Hungry Creek. Storms and snow melt can raise flows to flood levels in February, March, April, or May. Significant flooding occurred in 1982, 1983, and 1986. Summer flow is largely comprised of releases from the dam. Flow is 0.14 cms in very dry years, 0.28 cms in dry years, and 0.57 cms in normal or wet years (Hinton and Haines 1981).

Water quality and benthic organisms were sampled in six stations in 1979 in the study area by personnel from the Water Quality and Biology Unit of the Northern District of DWR. Dissolved oxygen averaged 9.8 ppm while pH averaged 7.3. Alkalinity was 44 mg\L as $CaCO_3$ while turbidity averaged 1.2 FTU. Dominant benthic macroinvertebrates were mayflies of the genus Baetis, stoneflies of the genus Hydropsyche, flies of the subfamily Chironominae, and flies of the genus Simulium (Boles 1980).

NAMES OF FISHES

The following species of fishes were caught in this study: rainbow trout (Oncorhynchus mykiss), brown trout (Salmo trutta), Sacramento sucker (Catostomus occidentalis), redear sunfish (Lepomis microlophus) and largemouth bass (Micropterus salmoides).

METHODS

Physical Measurements

Standing stocks of fishes were estimated at seven stations in Indian Creek (Figure 1 and Appendix 1). Stations were intentionally selected to be near stations sampled in previous DFG studies (Gerstung 1973). Markers had previously been placed in trees along the stream to identify station boundaries. Stations varied in length from 34.0 to 71.0 m. The length and width of each station was measured with metric tape measures. The depth of water was determined by measuring water depth at the center of five equally spaced intervals across five transects at each station.

Biological Measurements

Fish were captured with a battery-powered backpack electroshocker in stream sections blocked by seines as described by Platts et al. (1983). Captured fish were removed from the

net-enclosed section on each pass. Standing stock estimates were developed using the two-count method of Seber and LeCren (1967) or the multiple-pass method of Leslie and Davis (1939) with limits of confidence computed using a formula proposed by DeLury (1951).

The weights of trout and nongame fishes were measured by displacement. Fork length (FL) of each fish caught was measured to the nearest millimeter.

Scale samples were taken from brown trout and rainbow trout over 100 mm in length. Scales were taken just above the lateral line between the dorsal and adipose fin (Scarnecchia 1979) and placed in a piece of paper inserted in a small coin envelope (Drummond 1966). Scales were mounted dry between microscope slides, and their images were projected on a NCR microfiche reader at a magnification of 42x. Scale measurements for the calculation of growth were recorded to the nearest millimeter along the anterior radius of the anterior-posterior axis of the scale. Estimation of instantaneous population growth rate was calculated (Ricker 1975) with significant values of correlation coefficients taken from a table (Steel and Torrie 1960).

Instantaneous population growth rate = $b(\log_e l_2 - \log_e l_1)$

b = between ages functional slope
l_1 = initial length for the last complete year of growth
l_2 = final length for the last complete year of growth

Standing crops of brown trout and rainbow trout were calculated for individual stations

where each species was caught and then combined for the entire creek. Age and growth was calculated for the population (Everhart et al. 1975). Length-weight relationships were determined for both brown trout and rainbow trout (Lagler 1956). The coefficient of condition and 95 percent confidence intervals were calculated for all trout (Carlander 1969).

Distribution of all fish caught is listed according to location.

RESULTS

Distribution

Brown trout were caught at stations A through 6. Rainbow trout were caught at stations B, 5 and 6. Largemouth bass were caught in stations A, 3, 4 and 5. Redear sunfish were only caught in station A, while Sacramento suckers were only caught in station 6 (Table 1).

TABLE 1. Distribution of Fishes in Sections of Indian Creek, Plumas County, 1993.

	Station Number						
	A	2	3	B	4	5	6
Distance below Antelope Dam (km)	1.3	3.9	5.3	6.6	6.8	12.3	21.0
Brown trout	X	X	X	X	X	X	X
Rainbow trout				X		X	X
Largemouth bass	X		X	X	X	X	
Redear sunfish	X						
Sacramento sucker							X

Standing Crop

Brown trout were the most common game fish caught in Indian Creek. Biomass averaged 4.0 g/m^2 at seven stations. Biomass for brown trout large enough for anglers to catch and keep (127 mm FL and larger) averaged 3.8 g/m^2 (Table 2). Rainbow trout biomass averaged 1.1 g/m^2, while the biomass for catchable trout also averaged 1.1 g/m^2 (Table 3).

TABLE 2. Estimates of Brown Trout Standing Crop in Indian Creek, Plumas County, 1993.

Distance Bleow Antelope Dam (km)	Population Estimate	95 Percent Confidence Interval	Biomass (g/m^2)	Estimate of Catchable Trout ($\geq$ 127 mm FL)	Biomass of Catchable Trout (g/m^2)
1.3	18	18-19	6.4	18	6.4
3.9	37	37-39	5.6	34	5.5
5.3	32	31-36	5.1	31	4.9
6.6	31	29-37	6.5	28	6.3
6.8	19	19-20	2.5	14	2.3
12.3	12	11-18	1.7	7	1.5
21.0	1	1-1	0.1	0	0

TABLE 3. Estimates of Rainbow Trout Standing Crop in Indian Creek, Plumas County, 1993.

Distance Bleow Antelope Dam (km)	Population Estimate	95 Percent Confidence Interval	Biomass (g/m^2)	Estimate of Catchable Trout ($\geq$ 127 mm FL)	Biomass of Catchable Trout (g/m^2)
6.6	6	6-9	0.6	4	0.6
12.3	5	5-6	4.5	5	4.5
21.0	4	4-6	1.1	4	1.1

The formula L = 54.8 + 3.3 S describes the relationship between the fork length (L) and enlarged scale radius (S) of 136 brown trout caught in Indian Creek. The coefficient of correlation (r^2) is 0.52. The formula was L = 97.7 + 2.6 S for 12 rainbow trout caught, while the value for r^2 is 0.25.

Both the population instantaneous growth rate and the mean individual instantaneous growth rate were faster in age 1+ brown trout than in age 2+ trout. Population growth was faster than mean individual growth in 1+ fish (Table 4).

Population growth was faster than mean individual growth in age 1+ rainbow trout (Table 5).

TABLE 4. Growth Rates for Brown Trout Caught in Indian Creek, Plumas County, 1993.

	Population Growth			Mean Individual Growth		
Age Interval (mm)	Length Interval (mm)	Difference of Natural Logarithms	Instantaneous Growth Rate Gx	Length Interval (mm)	Difference of Natural Logarithms	Instantaneous Growth Rate Gx
1-2	80-186	0.844	2.535	94-186	0.682	2.046
2-3	186-258	0.327	0.981	151-258	0.536	1.608

TABLE 5. Growth Rates for Rainbow Trout Caught in Indian Creek, Plumas County, 1993.

	Population Growth			Mean Individual Growth		
Age Interval (mm)	Length Interval (mm)	Difference of Natural Logarithms	Instantaneous Growth Rate Gx	Length Interval (mm)	Difference of Natural Logarithms	Instantaneous Growth Rate Gx
1-2	88-172	0.670	1.943	91-172	0.637	1.847

Age 1+ brown trout averaged 163 mm in fork length; 2+ fish averaged 231 mm and 3+ trout averaged 286 mm (Table 6). Age 1+ and 2+ rainbow trout measured 176 mm and 210 mm, respectively (Table 7).

TABLE 6. Calculated Fork Length of Brown Trout from Indian Creek, Plumas County, 1993.

Age	No. of Fish	Length at Capture (mm)	Calculated Lengths at Successive Annuli		
			1	2	3
1	109	163	80	-	-
2	25	231	94	186	-
3	2	286	74	151	258
Number of back-calculations			136	27	2
Weighted means (mm)			82	183	258
Increments (mm)			82	101	75

TABLE 7. Calculated Fork Length of Rainbow Trout from Indian Creek, Plumas County, 1993.

Age	No. of Fish	Length at Capture (mm)	Calculated Lengths at a Successive Annuli	
			1	2
1	9	176	88	-
2	3	210	91	172
Number of back-calculations			12	3
Weighted means (mm)			83	172
Increments (mm)			83	89

Length and Weight

Age group 0+ brown trout represented 9 percent of the catch. Ages 1+ and 2+ fish represented 73 percent and 17 percent, respectively, while 3+ fish made up 1 percent (Figure 2). Age group 0+ rainbow trout represented 5 percent of the catch. Ages 1+ and 2+ trout made up 48 percent and 39 percent, respectively, while 3+ fish made up 8 percent (Figure 3). (Appendices 2 and 4).

The relationship between length (L) and weight (W) of brown trout is:

$$\text{Log}_{10} W = -4.9 + 3.0 \text{ Log}_{10} L$$

$$r^2 = 0.99$$

N = 150 (Figure 4 and Appendix 3)

The same relationship for rainbow trout is:

$$\text{Log}_{10} W = -4.7 + 2.9 \text{ Log}_{10} L$$

$$r^2 = 0.99$$

N = 23 (Figure 5 and Appendix 5)

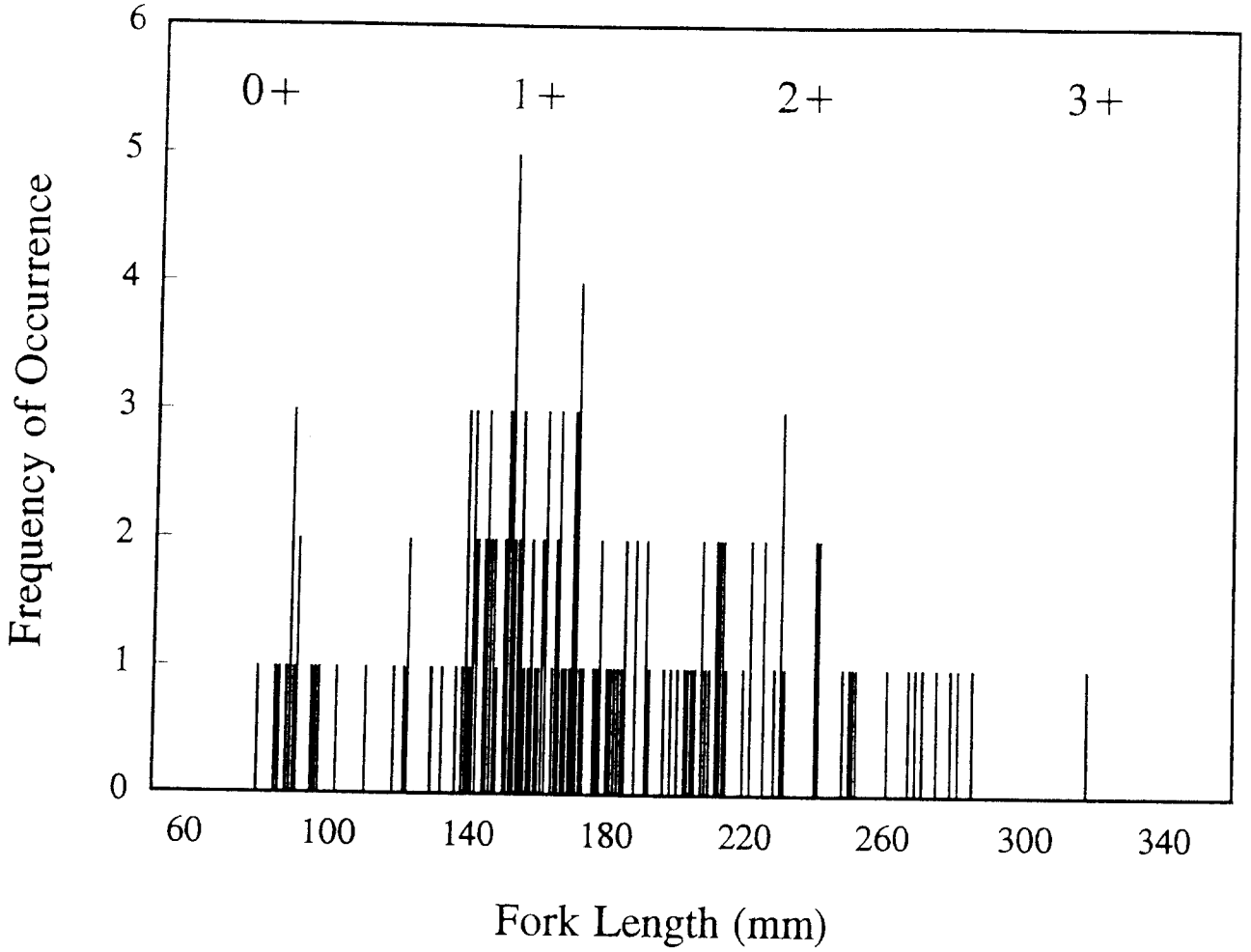

FIGURE 2. Length, observed frequency, and age of brown trout caught in Indian Creek, Plumas County, 1993.

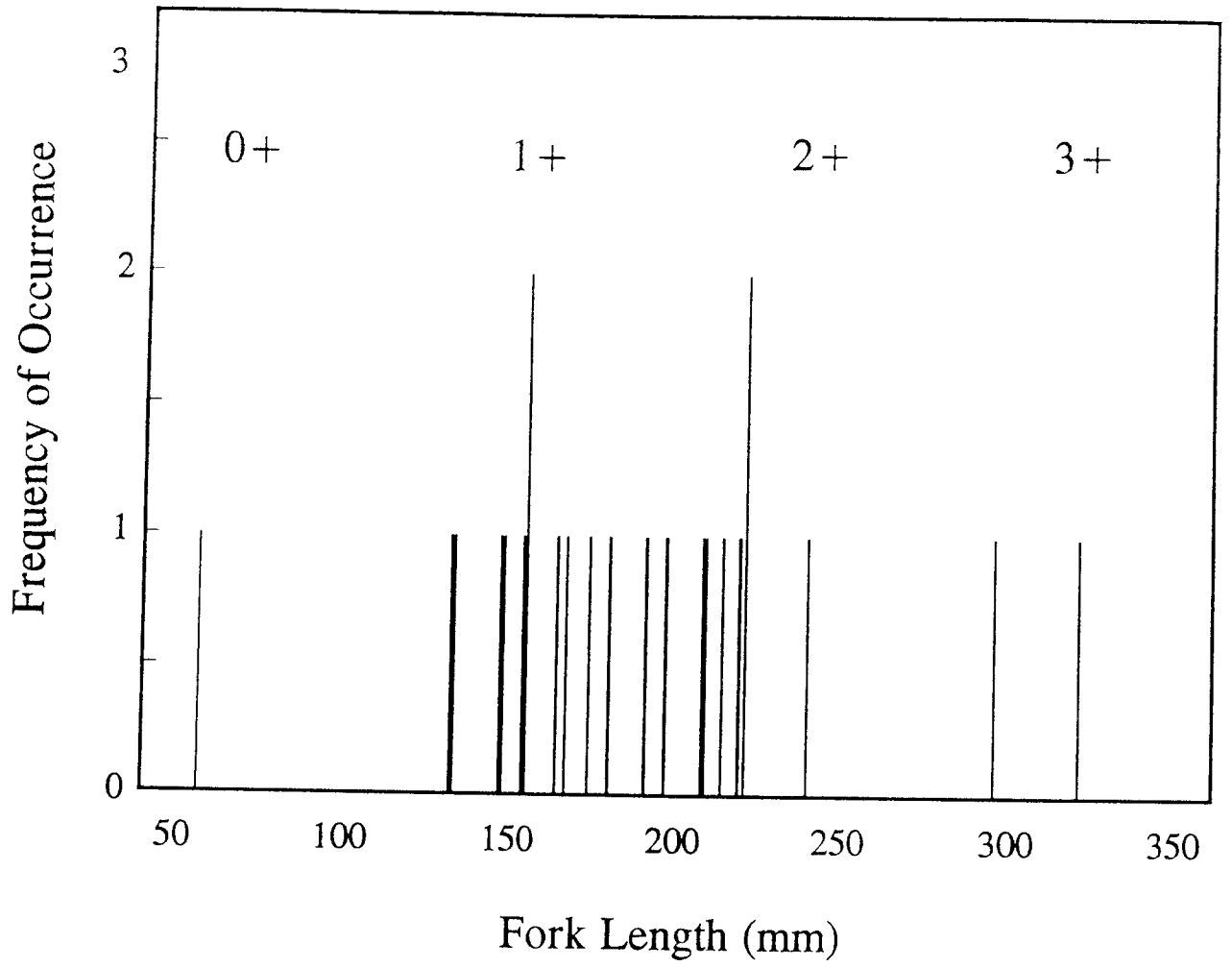

FIGURE 3. Length, observed frequency, and age of rainbow trout caught in Indian Creek, Plumas County, 1993.

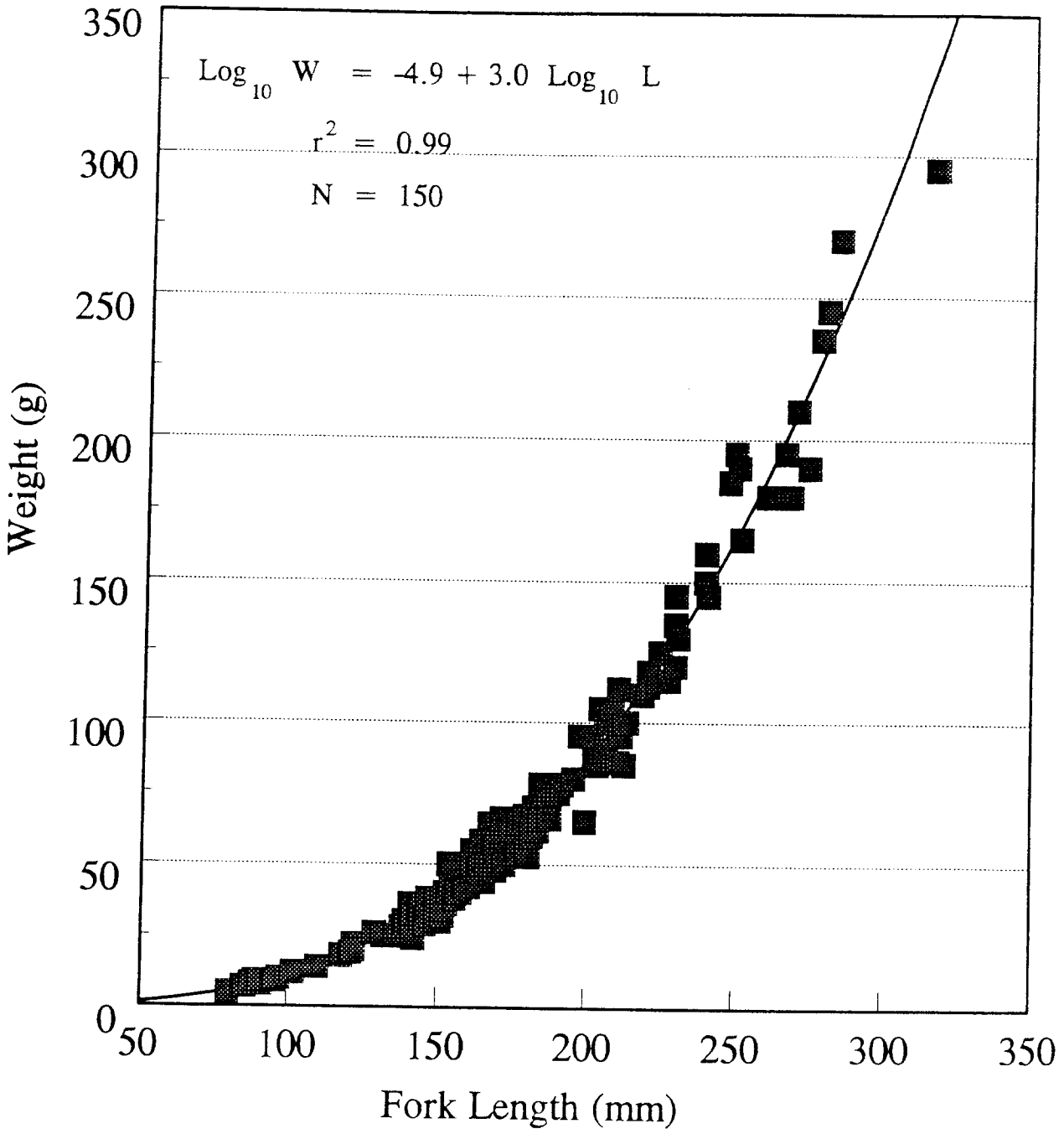

FIGURE 4. The relationship between length and weight of brown trout caught in sections of Indian Creek, Plumas County, 1993.

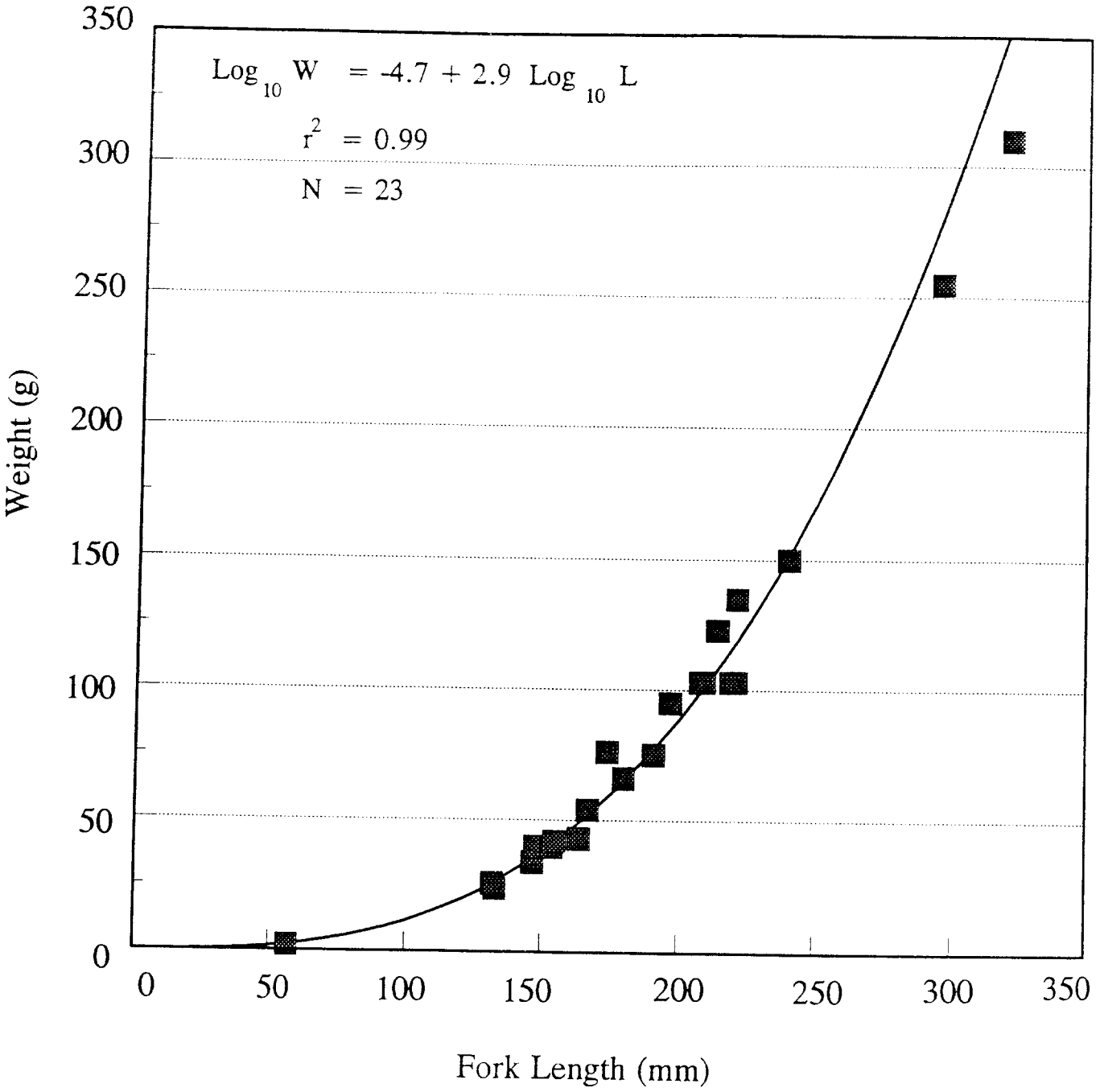

FIGURE 5. The relationship between length and weight of rainbow trout caught in sections of Indian Creek, Plumas County, 1993.

Coefficient of Condition

We calculated the coefficient of condition and 95 percent confidence limits for a total of 150 brown trout and 23 rainbow trout (Table 8).

TABLE 8. Condition of Brown Trout and Rainbow Trout in Indian Creek, Plumas County, 1993.

Age Group	Number of Fish	Coefficient of Condition	95% Confidence Interval
Brown Trout			
0+	13	1.1223	0.9617-1.2830
1+	109	1.0826	0.8739-1.2914
2+	25	1.0728	0.9111-1.2344
3+	3	1.0462	0.8107-1.2817
Combined	150	1.0840	0.8842-1.2837
Rainbow Trout			
0+	1	1.0800	
1+	11	1.1383	0.8985-1.3780
2+	9	1.1293	0.9236-1.3351
3+	2	1.4313	0.7378-2.1248
Combined	23	1.1586	0.8176-1.4996

DISCUSSION

Population estimates and biomass of both brown and rainbow trout were below most values for previous years (Table 9). Low summer flows over the past three years reduced available rearing habitat and limited production. Summer flow and trout habitat are related in

Indian Creek (Hinton and Haines 1981). The relationship between summer flow and brown trout populations is highly significant ($p < 0.01$), while the relationship between flow and population of all trout is also significant ($p < 0.05$). Catchable-sized trout greatly benefit from higher summer flows. The correlations between flow and catchable brown and rainbow trout are highly significant ($p < 0.01$) (Brown 1993).

TABLE 9. Population estimates and biomass of rainbow and brown trout in Indian Creek, 1977-1993.

	Rainbow Trout		Brown Trout	
Date	Biomass ($g\backslash m^2$)	Population Estimate ($no\backslash m^2$)	Biomass ($g\backslash m^2$)	Population Estimate ($no\backslash m^2$)
1977	0.7	0.01	5.7	0.16
1978	0.4	0.01	5.0	0.07
1979	1.2	0.02	4.9	0.42
1980	2.7	0.07	5.8	0.16
1981	0.7	0.01	5.0	0.19
1982	0.4	0.05	4.4	0.09
1986	0.9	0.04	2.8	0.03
1987	2.1	0.01	4.6	0.18
1988	0.3	0.01	5.6	0.67
1989	0.6	0.01	5.7	0.12
1990	2.2	0.02	4.2	0.17
1993	0.5	0.01	4.0	0.07
Mean	1.1	0.02	4.8	0.19

Indian Creek was subjected to high flow during spring of 1993. Few age 0 brown or rainbow trout survived. The abundance of young brown and rainbow trout in Indian Creek is

significantly ($P < 0.05$) correlated with spring floods (Brown 1993). Spring floods devastated age 0 trout in Indian Creek in 1982 and 1986 based on population sampling the following September. High flows in April and May 1982 and March in 1986 destroyed redds, killing eggs, and washing newly emerged trout out of the study area. Spring floods can decimate eggs and young of fall spawning trout (Seegrist and Gard 1972, Hansen and Waters 1974, Harvey 1987). Young-of-the-year trout are more strongly affected by floods than adults because of their limited swimming ability and small size. Young of the year rainbow trout are also negetatively affected by spring floods (Pearsons et al. 1992). Floods can result in the loss of two year classes due to destruction of eggs and fry and mortality of older trout due to loss of habitat (Hansen and Waters 1974).

Rates of instantaneous population growth were above average for brown and rainbow trout in 1993 (Table 10). Growth was high because the relatively few trout that survived years of low flow were exposed to greatly improved rearing habitat in 1993 as summer flow was increased to 0.57 cms. Growth in Indian Creek could be related to flow because increased flows increase useable habitat for food production and cover (Hinton and Haines 1981), two elements that influence productivity, standing crops, and growth (Saunders and Smith 1963, Lewis 1969, Mesick 1968, Wesche et al. 1987, Jowett 1992).

TABLE 10. Estimates of Instantaneous Population Growth Rate (g) of Brown Trout and Rainbow Trout in Indian Creek.

	Brown Trout		Rainbow Trout	
	Age Interval		Age Interval	
Year	I-II	II-III	I-II	II-III
1978	2.214	0.938		
1979	1.394	1.670		
1980	2.086	1.219		
1981	1.850	1.505		
1982	2.029	-	1.541	
1986	1.777	0.965	1.242	1.151
1987	1.974	1.012	2.080	1.070
1988	2.616	0.605	1.329	
1989	2.288	-	1.856	
1990	2.154	1.776	2.378	
1993	2.535	0.981	1.943	
Mean	2.084	0.919	1.738	1.111

LITERATURE CITED

Boles, G. 1980. Indian Creek survey. Calif. Dept. of Water Resources. 11 p.

Brown, C. J. 1978. Standing stocks of fishes in sections of Indian Creek, Plumas County, 1977. Calif. Dept. of Fish and Game. 23 p.

_____. 1991a. Standing stocks of fishes in sections of Indian Creek, Plumas County, 1989. Calif. Dept. of Fish and Game. 19 p.

_____. 1991b. Standing stocks of fishes in sections of Indian Creek, Plumas County, 1990. Calif. Dept. of Fish and Game. 20 p.

_____ and S. Haines. 1979. Standing stocks of fishes in sections of Indian Creek, Plumas County, 1978. Calif. Dept. of Fish and Game. 14 p.

_____. 1993. A summary of studies of fish populations in Indian Creek, Plumas County, 1977-1990. Calif. Dept. of Fish and Game. 30 p.

Bumpass, D. K., and C. J. Brown. 1989. Standing stocks of fishes in sections of Indian Creek, Plumas County, 1988. Calif. Dept. of Fish and Game. 14 p.

_____ and K. Smith, 1989. Standing stocks of fishes in sections of Indian Creek, Plumas County, 1987. Calif. Dept. of Fish and Game. 14 p.

_____, K. Smith, and C. J. Brown. 1987a. Standing stocks of fishes in sections of Indian Creek, Plumas County, 1982. Calif. Dept. of Fish and Game. 14 p.

_____. 1987b. Standing stocks of fishes in sections of Indian Creek, Plumas County, 1986. Calif. Dept. of Fish and Game. 14 p.

Carlander, K.D. 1969. Handbook of Freshwater Fishery Biology, Vol. 1. Ames, Iowa: The Iowa State University Press. 752 p.

DeLury, D. B. 1951. On the planning of experiments for the estimation of fish populations. J. Fish. Res. Bd. Canada. 8:281-307.

Department of Water Resources. 1979. Preliminary study of instream enhancement opportunities. Calif. Dept. of Water Resources. 113 p.

Drummond, R.A. 1966. Techniques in the collection and mounting of trout scales. Progressive Fish Culturist 28(2): 113-116.

Everhart, H.W., A.W. Eipper, and W.D. Youngs. Principles of Fishery Science. Ithaca, N.Y.:Cornell University Press. 288 p.

Gerstung, E.R. 1973. Fish populations and yield estimates from California streams. Cal-Neva Wildlife 9-19.

Haines, S., and C. J. Brown. 1980. Standing stocks of fishes in sections of Indian Creek, Plumas County, 1979. Calif. Dept. of Fish and Game. 14 p.

Hansen, D.L. and T.F. Waters. 1974. Recovery of standing crop and production rate of a brook trout population in a flood damaged stream. Trans. Amer. Fish. Soc. 103(3): 431-439.

Harvey, B.C. 1987. Susceptibility of young-of-the-year fishes to downstream displacement by flooding. Trans. Amer. Fish. Soc. 116(6):851-855.

Hinton, R.N. 1983. Recreation use survey of Indian Creek, Plumas County, 1982. Calif. Dept. Water Resources, Technical Information Report No. 83-1. 18 p.

_____. and S.L. Haines. 1981. Evaluation of a revised operation for Antelope Reservoir. Calif. Dept. Water Resources, Northern District Report. 58 p.

Jowett, I.G. 1992. Models of the abundance of large brown trout in New Zealand rivers. North American Journal of Fisheries Management 12(3): 417-432.

Lagler, K.F. 1956. Freshwater Fishery Biology. Dubuque, Iowa: Wm. C. Brown. 421 p.

Leslie, P. H., and D. H. S. Davis. 1939. An attempt to determine the absolute number of rats in a given area. J. Animal Ecology. 8:94-113.

Lewis, S.L. 1969. Physical factors influencing fish populations in pools of a trout stream. Trans. Amer. Fish. Soc. 98(1): 14-19.

Mesick, C.F. Effects of food and cover on numbers of Apache and brown trout establishing residency in artificial stream channels. Trans. Amer. Fish. Soc. 117(5): 421-431.

Pearsons, T.N., H.W. Li, and G.A. Lamberti. 1992. Influence of habitat complexity on resistance to flooding and resilience of stream fish assembledges. Trans. Amer. Fish. Soc. 121(4): 427-436.

Platts, W.S., W.F. Megahan, and G.W. Minshall. 1983. Methods for evaluating stream, riparian, and biotic conditions. Gen. Tech. Rep. INT-138. Ogden, UT: U.S. Department of Agriculture, Forest Service, Intermountain Forest and Range Experimental Station; 1983. 70p.

Ricker, W. E. 1975. Computation and interpretation of biological statistics of fish populations. Fish. Res. Bd. Canada. Bull. 191.

Saunders, J.W. and M.W. Smith. 1962. Physical alteration of stream habitat to improve brook trout production. Trans. Amer. Fish. Soc. 91(2): 185-188.

Scarnecchia, D.L. 1979. Variation of scale characteristics of coho salmon with sampling location on the body. Progressive Fish Culturist 41(3): 132-135.

Seber, G. A. F., and E. D. LeCren. 1967. Estimating population parameters from catches large relative to the population. J. Animal Ecology. 36(3):631-643.

Seegrist D.W. and R. Gard. 1972. Effects of floods on trout in Sagehen Creek, California. Trans. Amer. Fish. Soc. 103(3): 478-482.

Steel, R.G.D. and J.H. Torrie. 1960. Principles and Procedures of Statistics. McGraw-Hill Book Company, Inc. 481 p.

Villa, N. 1982. Standing stocks of fishes in sections of Indian Creek, Plumas County, 1981. Calif. Dept. of Fish and Game. 23 p.

_____ and C.J. Brown. 1981. Standing stocks of fishes in sections of Indian Creek, Plumas County, 1980. Calif. Dept. of Fish and Game. 23 p.

Wesche, T.A., C.M. Goertler, and W.A. Hubert. 1987. Modified habitat suitability index model for brown trout in southwestern Wyoming. North American Journal of Fisheries Management 7(2): 232-237.

APPENDIX 1

FISH POPULATION STATIONS ON INDIAN CREEK, PLUMAS COUNTY, SEPTEMBER 1993 AT 0.56 CMS

Station	Distance Below Antelope Dam	UTM	Length (m)	Surface Area (m^2)	Volume (m^3)
A	1.3	035 493	51.9	311.4	208.0
2	3.9	025 467	39.5	331.0	120.8
3	5.3	024 453	71.0	390.5	105.4
B	6.6	010 423	39.0	366.4	115.8
4	6.8	024 445	48.5	320.1	120.7
5	12.3	009 409	43.0	318.2	100.6
6	21.0	982 377	34.0	183.6	66.8

APPENDIX 2

LENGTH AND NUMBER OF BROWN TROUT
CAUGHT IN INDIAN CREEK, SEPTEMBER 1993

Fork Length (mm)	Frequency	Fork Length (mm)	Frequency	Fork Length (mm)	Frequency
80	1	156	1	200	1
85	1	157	1	202	1
86	1	158	2	203	1
88	1	159	1	204	1
89	3	160	1	205	1
90	1	161	2	207	2
91	2	162	3	208	1
95	1	164	1	209	1
96	1	165	2	211	2
97	1	166	3	212	2
102	1	167	1	213	2
110	1	168	1	214	1
118	1	169	1	219	1
121	1	170	3	221	2
122	2	171	4	225	2
129	1	172	1	228	1
132	1	173	1	230	3
136	1	176	1	231	1
138	1	177	1	240	2
139	3	178	2	241	2
140	1	180	1	248	1
141	3	181	1	250	1
142	2	182	1	251	1
144	2	183	1	252	1
145	3	184	1	261	1
146	2	185	2	267	1
147	2	188	3	269	1
148	1	191	2	271	1
150	2	192	1	275	1
151	3	196	1	279	1
152	5	198	1	281	1
153	2			285	1
154	2			317	1
155	3				

APPENDIX 3
LENGTH AND WEIGHT OF BROWN TROUT
CAUGHT IN INDIAN CREEK, SEPTEMBER 1993

Fork Length (mm)	Weight (g)	Fork Length (mm)	Weight (g)	Fork Length (mm)	Weight (g)	Fork Length (mm)	Weight (g)
80	5	152	38	184	62	271	210
85	7	152	34	185	66	275	190
86	7	152	36	185	78	279	235
88	8	152	36	188	68	281	245
89	8	153	36	188	68	285	270
89	8	153	40	188	66	317	295
89	9	154	40	191	75		
90	9	154	50	191	75		
91	8	155	48	192	78		
91	9	155	47	196	80		
95	9	155	42	198	95		
96	9	156	38	200	65		
97	10	157	40	202	95		
102	2	158	48	203	87		
110	14	158	40	204	85		
118	18	159	42	205	105		
121	19	160	42	207	90		
122	22	161	42	207	100		
122	20	161	50	208	100		
129	26	162	48	209	105		
132	25	162	50	211	86		
136	25	162	55	211	112		
138	28	164	48	212	95		
139	28	165	58	212	100		
139	30	165	50	213	100		
139	30	166	48	213	85		
140	30	166	46	214	100		
141	32	166	44	219	110		
141	30	167	50	221	118		
141	36	168	64	221	113		
142	32	169	58	225	125		
142	24	170	48	225	125		
144	36	170	56	228	115		
144	35	170	56	230	120		
145	30	171	50	230	135		
145	36	171	55	230	145		
145	34	171	56	231	130		
146	29	171	53	240	150		
146	30	172	66	240	160		
147	35	173	50	241	145		
147	38	176	60	241	145		
148	32	177	55	248	185		
150	33	178	64	250	195		
150	38	178	54	251	190		
151	36	180	67	252	165		
151	36	181	53	261	180		
151	30	182	60	267	195		
152	32	183	70	269	180		

APPENDIX 4

LENGTH AND NUMBER OF RAINBOW TROUT
CAUGHT IN INDIAN CREEK, SEPTEMBER 1993

Fork Length (mm)	Frequency
57	1
132	1
133	1
147	1
148	1
154	1
155	2
164	1
167	1
174	1
180	1
191	1
197	1
208	1
209	1
214	1
219	1
221	2
240	1
296	1
321	1

APPENDIX 5

LENGTH AND WEIGHT OF RAINBOW TROUT
CAUGHT IN INDIAN CREEK, SEPTEMBER 1993

Fork Length (mm)	Weight (g)
57	2
132	26
133	24
147	34
148	40
154	40
155	42
155	42
164	43
167	54
174	76
180	66
191	75
197	95
208	103
209	103
214	123
219	103
221	103
221	135
240	150
296	255
321	310

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